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Morphological and compositional characterization of gold contained in ferricretes of a weathered profile (Minvoul greenstone belt, Gabon)

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INTRODUCTION AND OBJECTIVES

This study presents the quantification and morphological characterization of particles and nuggets of almost pure gold found in the iron duricrust of a weathering profile of the Archean greenstone belt of Minvoul (Republic of Gabon). The weathered profile on the area (Figure 1) was defined through pits and trenches and consists, from bottom to top, on saprolite, mottled clay zone, iron duricrust, pisolitic gravels and yellow latosol. The iron duricrust constitutes a hard continuous layer, which is concretionary and pisolitic and consists of cemented nodules of goethite, hematite and other iron oxides and hydroxides. Samples from this horizon contain abundant particles of gold. The study of morphology and microchemical composition of gold grains has been widely used as a tool for the understanding of the dissolution, dispersion and gold concentration processes in supergene environments, and for determining the primary or secondary origin of gold grains across the lateritic horizons (Webster and Mann, 1984; Butt and Hough, 2006). Moreover, the results obtained represent a contribution for the knowledge of the gold-potential of the Ntem complex greenstone belts where mineralization on bedrock remains unknown.

METHODOLOGY

The processes of quantification and morphological characterization of gold particles were carried out by means of the Optical Image Analysis (OIA) technique and by the compositional analysis of microprobes of gold grains using Automated Electron Microprobe and Scanning Electron Microscopy. The OIA was carried out in 37 images of 454 gold grains following the main stages of image analysis (acquisition, segmentation and quantification).

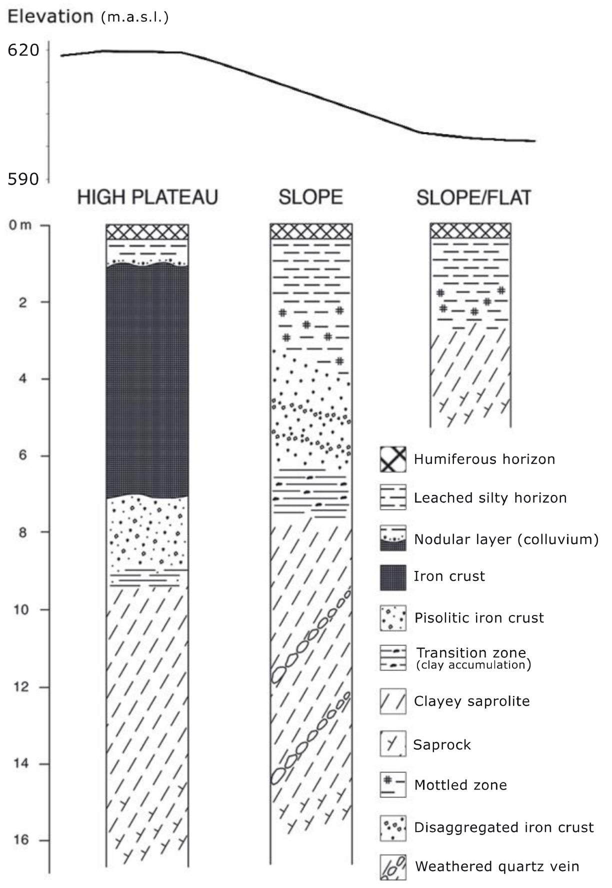

Figure 1.- Schematic representation of the typical lateritic profile through an amphibolitic sequence at Minvoul area.

The microchemical analysis consisted in the characterization of a population of gold grains by electron probe microanalysis (EPMA) in which the concentration of gold and other minor alloying elements (Ag, Cu, Hg, etc.) were determined

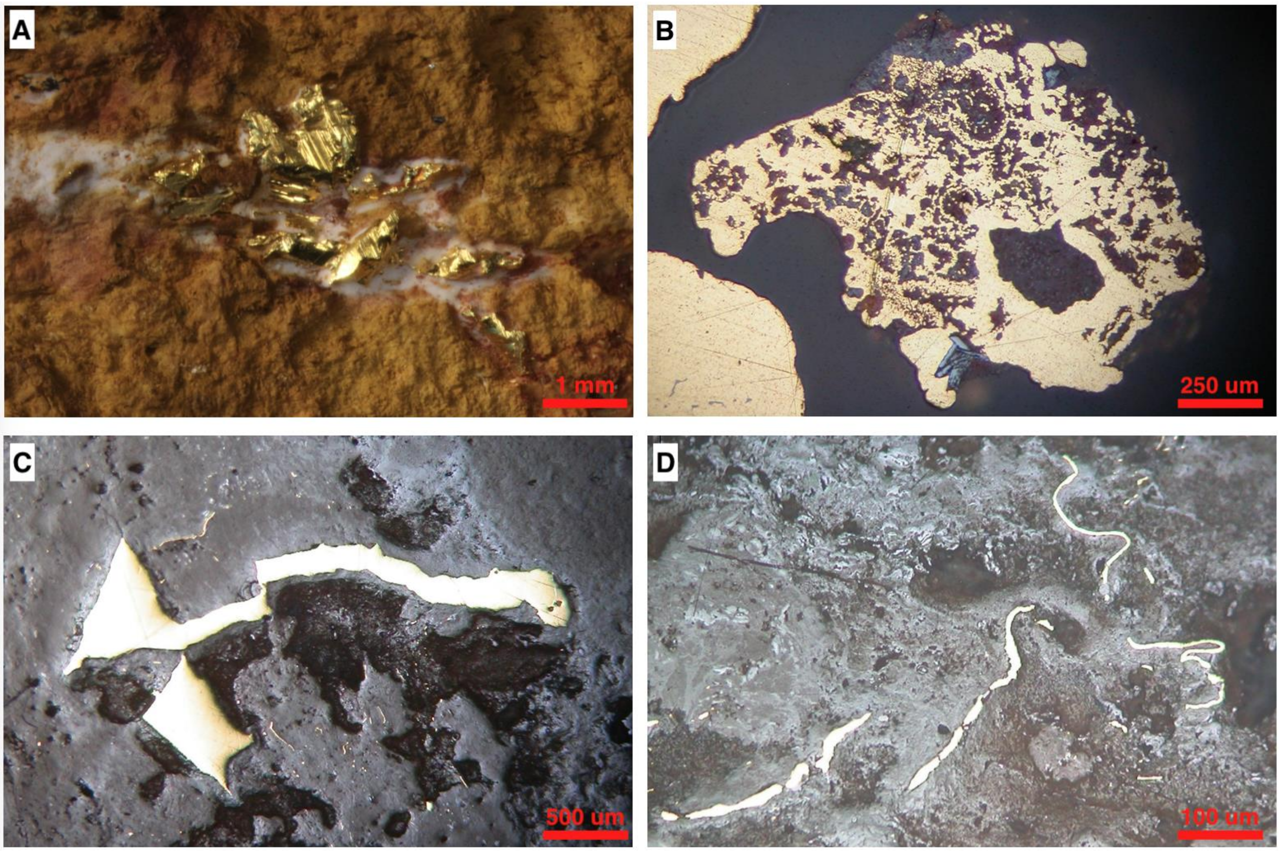

Figure 2.- Microphotographs of gold embedded in the iron duricrust. A) Gold crystals filling voids associated with amorfous silica; B) intergrowth of gold, limonite and hematite in a gold grain; C) fractured gold grain; D) folded filamentous gold in the lateritic matrix

together with the suite of opaque and non-opaque inclusion assemblages. Petrographic observations of gold-bearing ferricrete fragments allowed defining the main textural relationships between the gold particles and the lateritic matrix.

RESULTS

Gold grains embedded in the ferricrete (Figure 2) occur as tiny disseminated filaments as well as large crystals, up to several millimetres long, in voids and fractures within the ferruginous lateritic matrix. Gold is seen to have been precipitated along syn-sedimentary cracks, likely produced by dehydration processes, although this process has not been studied enough yet. The close relationship between gold and neoformed Fe-oxides such as partial intergrowths with hematite crystals and discontinuous limonitic coatings seem to indicate precipitation from groundwater solutions in the supergene conditions contemporarily with the lateritization. Gold grains present a narrow range in composition, especially with respect to silver content. Gold fineness expressed as [(Au/Au+Ag) x 1000] in weight % has been commonly used to determine secondary gold enrichment in lateritic environments (Santosh et al., 1992; de Oliveira and de Oliveira, 2000) Most of the gold showed fineness values higher than 999 with Au contents (wt%) that range from 99 to 100.

CONCLUSIONS

A secondary origin for gold in the duricrust is suggested by the large size of the nuggets, their fineness (>999 in average) and the close textural relationship between gold and the neoformed iron oxy-hydroxides.

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